

1    WHAT IS CLAIMED IS:

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3    1.    A process for oligomerizing a Fischer-Tropsch derived feed containing

4    oxygenates which comprises:

5

6        (a)    reducing significantly the oxygenates present in the

7        Fischer-Tropsch derived feed by contacting said feed with a

8        hydrotreating catalyst under hydrotreating conditions in a

9        hydrotreating zone and recovering from the hydrotreating zone a

10      Fischer-Tropsch derived hydrotreated feed which contains a

11      significantly reduced amount of oxygenates as compared to the

12      Fischer-Tropsch derived feed and also a significant amount of

13      paraffins;

14

15        (b)    pyrolyzing the Fischer-Tropsch derived hydrotreated feed in a

16        thermal cracking zone under thermal cracking conditions

17        pre-selected to crack the paraffin molecules to form olefins and

18        collecting an olefin-enriched Fischer-Tropsch feed from the

19        thermal cracking zone;

20

21        (c)    contacting the olefin-enriched Fischer-Tropsch feed with a Lewis

22        acid ionic liquid catalyst in an oligomerization zone under

23        oligomerization reaction conditions; and

24

25        (d)    recovering from the oligomerization zone a Fischer-Tropsch

26        derived product having molecules characterized by a higher

27        average molecular weight and increased branching as

28        compared to the Fischer-Tropsch derived feed.

29

30    2.    The process of claim 1 wherein the Fischer-Tropsch derived

31    hydrotreated feed is substantially free of oxygenates.

- 1    3.    The process of claim 2 wherein the Fischer-Tropsch derived
- 2                hydrotreated feed contains less than 200 ppmw elemental oxygen.
- 3
- 4    4.    The process of claim 3 wherein the Fischer-Tropsch derived
- 5                hydrotreated feed contains less than 100 ppmw elemental oxygen.
- 6
- 7    5.    The process of claim 1 wherein the hydrotreating catalyst is a
- 8                non-acidic hydrotreating catalyst.
- 9
- 10   6.    The process of claim 5 wherein the hydrotreating catalyst contains the
- 11                metal nickel and molybdenum.
- 12
- 13   7.    The process of claim 1 wherein the hydrotreating conditions in the
- 14                hydrotreating zone include a temperature of between about
- 15                400 degrees F and about 800 degrees F, an LHSV of between about
- 16                0.5 and about 5.0, and a total pressure between about 200 psig and
- 17                about 2,000 psig.
- 18
- 19   8.    The process of claim 7 wherein the temperature in the hydrotreating
- 20                zone is less than about 675 degrees F.
- 21
- 22   9.    The process of claim 7 wherein the LHSV is between about 1 and
- 23                about 4.0.
- 24
- 25   10.   The process of claim 1 wherein the temperature in the thermal cracking
- 26                zone is within the range of from about 950 degrees F and about
- 27                1,600 degrees F.
- 28
- 29   11.   The process of claim 1 wherein the pressure in the thermal cracking
- 30                zone is within the range of from about to about 0 atmospheres and
- 31                about 5 atmospheres.

1 12. The process of claim 11 wherein the pressure in the thermal cracking  
2 zone is within the range of from about 0 atmospheres and  
3 about 2 atmospheres.

4

5 13. The process of claim 1 wherein the cracking conversion in the thermal  
6 cracking zone is greater than about 10 weight percent of the paraffins  
7 present.

8

9 14. The process of claim 1 wherein the ionic liquid oligomerization catalyst  
10 comprises a first component and a second component, said first  
11 component comprising a compound selected from the group consisting  
12 of aluminum halide, alkyl aluminum halide, gallium halide, and alkyl  
13 gallium halide, and said second component is a quaternary ammonium,  
14 or quaternary phosphonium salt.

15

16 15. The process of claim 14 wherein the ratio of the first component to the  
17 second component is within the range of from about 1:1 to about 2:1.

18

19 16. The process of claim 14 wherein said first component is aluminum  
20 halide or alkyl aluminum halide.

21

22 17. The process of claim 14 wherein said second component is selected  
23 from one or more of hydrocarbyl substituted ammonium halide,  
24 hydrocarbyl substituted imidazolium halide, hydrocarbyl substituted  
25 pyridinium halide, alkylene substituted pyridinium dihalide, or  
26 hydrocarbyl substituted phosphonium halide.

27

28 18. The process of claim 1 including the additional step of dewaxing the  
29 Fischer-Tropsch derived product recovered from the oligomerization  
30 zone and collecting a dewaxed Fischer-Tropsch product having  
31 improved cold flow properties relative to the Fischer-Tropsch derived  
32 product recovered from the oligomerization zone.

1       19. The process of claim 18 wherein the Fischer-Tropsch derived product  
2       is catalytically dewaxed.

3

4       20. The process of claim 18 including the additional step of hydrofinishing  
5       the dewaxed Fischer-Tropsch product.

6

7       21. The process of claim 1 wherein the Fischer-Tropsch derived product  
8       includes lubricant base oil.

9

10      22. The process of claim 1 wherein the Fischer-Tropsch derived product  
11      includes a diesel product.

12

13      23. A process for producing Fischer-Tropsch derived lubricant base oil  
14      which comprises:

15

16       (a) recovering from a Fischer-Tropsch plant a wax fraction;

17

18       (b) reducing significantly the oxygenates present in the  
19       Fischer-Tropsch wax fraction by contacting said wax fraction  
20       with a hydrotreating catalyst under hydrotreating conditions in a  
21       hydrotreating zone and recovering from the hydrotreating zone a  
22       hydrotreated Fischer-Tropsch derived wax feed which contains  
23       a significantly reduced amount of oxygenates as compared to  
24       the Fischer-Tropsch derived wax fraction and also a significant  
25       amount of paraffins;

26

27       (c) pyrolyzing the hydrotreated Fischer-Tropsch derived wax feed in  
28       a thermal cracking zone under thermal cracking conditions  
29       pre-selected to crack the paraffin molecules to form olefins and  
30       collecting an olefin-enriched Fischer-Tropsch feed from the  
31       thermal cracking zone;

1 (d) contacting the olefin-enriched Fischer-Tropsch feed with a Lewis  
2 acid ionic liquid catalyst in an oligomerization zone under  
3 oligomerization reaction conditions;

4

5 (e) recovering from the oligomerization zone a Fischer-Tropsch  
6 derived oligomerization effluent having molecules characterized  
7 by a higher average molecular weight and increased branching  
8 as compared to the Fischer-Tropsch derived feed;

9

10 (f) catalytically dewaxing the Fischer-Tropsch derived  
11 oligomerization effluent by contacting the Fischer-Tropsch  
12 derived oligomerization effluent with a dewaxing catalyst under  
13 catalytic conditions in a dewaxing zone and collecting a  
14 dewaxed Fischer-Tropsch product from the dewaxing zone  
15 having improved cold flow properties relative to the  
16 Fischer-Tropsch derived oligomerization effluent;

17

18 (g) hydrofinishing the dewaxed Fischer-Tropsch product in a  
19 hydrofinishing zone under hydrofinishing conditions in the  
20 presence of a hydrofinishing catalyst; and

21

22 (h) collecting a Fischer-Tropsch derived lubricant base oil from the  
23 hydrofinishing zone.

24

25 24. The process of claim 23 wherein the oxygenates in the hydrotreated  
26 Fischer-Tropsch derived wax feed recovered from the hydrotreating  
27 zone is substantially oxygenate free.

28

29 25. The process of claim 24 wherein the hydrotreated Fischer-Tropsch  
30 derived wax feed recovered from the hydrotreating zone contains less  
than 200 ppmw elemental oxygen.

1 26. A process for producing Fischer-Tropsch derived lubricant base oil  
2 which comprises:  
3  
4 (a) recovering from a Fischer-Tropsch plant a condensate fraction;  
5  
6 (b) removing substantially all of the oxygenates present in the  
7 Fischer-Tropsch condensate fraction by contacting said  
8 condensate fraction with a hydrotreating catalyst under  
9 hydrotreating conditions in a hydrotreating zone and recovering  
10 from the hydrotreating zone a substantially oxygenate-free  
11 Fischer-Tropsch derived condensate feed which also contains a  
12 significant amount of paraffins;  
13  
14 (c) pyrolyzing the substantially oxygenate-free Fischer-Tropsch  
15 derived condensate feed in a thermal cracking zone under  
16 thermal cracking conditions pre-selected to crack the paraffin  
17 molecules to form olefins and collecting an olefin-enriched  
18 Fischer-Tropsch feed from the thermal cracking zone;  
19  
20 (d) contacting the olefin-enriched Fischer-Tropsch feed with a Lewis  
21 acid ionic liquid catalyst in an oligomerization zone under  
22 oligomerization reaction conditions;  
23  
24 (e) recovering from the oligomerization zone a Fischer-Tropsch  
25 derived oligomerization effluent having molecules characterized  
26 by a higher average molecular weight and increased branching  
27 as compared to the Fischer-Tropsch derived feed;  
28  
29 (f) catalytically dewaxing the Fischer-Tropsch derived  
30 oligomerization effluent by contacting the Fischer-Tropsch  
31 derived oligomerization effluent with a dewaxing catalyst under  
32 catalytic conditions in a dewaxing zone and collecting a  
dewaxed Fischer-Tropsch product from the dewaxing zone

having improved cold flow properties relative to the Fischer-Tropsch derived oligomerization effluent;

3

4 (g) hydrofinishing the dewaxed Fischer-Tropsch product in a  
5 hydrofinishing zone under hydrofinishing conditions in the  
6 presence of a hydrofinishing catalyst; and

7

8 (h) collecting a Fischer-Tropsch derived lubricant base oil from the  
9 hydrofinishing zone.

10

11 27. The process of claim 26 wherein the substantially oxygenate-free  
12 Fischer-Tropsch derived condensate feed recovered from the  
13 hydrotreating zone contains less than 200 ppmw elemental oxygen.

14

15 28. The process of claim 27 wherein the substantially oxygenate-free  
16 Fischer-Tropsch derived condensate feed recovered from the  
17 hydrotreating zone contains less than 100 ppmw elemental oxygen.

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19 29. The process of claim 26 wherein a diesel product is also collected from  
20 the hydrofinishing zone.